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Original Article

EFFECT OF POST-HARVEST CHEMICALS ON STORABILITY OF SAPOTA CV. KALIPATTI

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ABSTRACT

Sapota (Achras zapota L) is considered as an economically important fruit crop, acceptable by the consumers. It is highly perishable with various post-harvest losses and has a limited post-harvest life of 4–5 days. Now-a-days various chemicals are used to extend the shelf life and quality of sapota. To access the post-harvest effect of chemicals on the storability of sapota cv. Kalipatti, the present investigation was carried out in the Laboratory of Department of Horticulture, Khalsa College, Amritsar during the year 2018–2019 to find out the best chemical for sapota storability. The experiment was carried out with four chemicals under cold storage conditions making in all 13 treatments with three replications i.e. $CaCl_2$ (2, 4, 6%), SA (1, 2, 3 mM), Kinetin (50, 100, 150 ppm), $KMnO_4$ (1000,1500, 2000 ppm) and untreated fruits following Factorial Randomised Block Design. The treated sapota fruits of cv. Kalipatti were stored at cold storage (15–20°C, 85–90% RH). In the present study, it was observed that sapota fruits under all the treatment combinations had increased total weight loss, rotting, fruit softening and fruit skin shrinkage with subsequent increase in storage period. There was an increase followed by a gradual decrease in TSS, reducing and total sugar content with corresponding decrease in acidity upon prolonged storage. The shelf life of untreated fruits was found to be good hardly for 10 days at cold storage. The present study made it clear that the treatment of sapota fruits with 4 and 6% calcium chloride was the best and it had a great significance in retaining the better physico-chemical characteristics. This treatment combination could extend the shelf-life of sapota fruits with better marketable qualities while untreated fruits had lost almost complete marketable qualities.

***KEYWORDS:** Acidity, Cold Storage, Marketable, Physico-Chemical, Quality, Sapota & Shelf Life*

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INTRODUCTION

Sapota (*Manilkara achras* (Mill.) Fosberg) belongs to family Sapotaceae is an evergreen fruit tree commercially grown in India. It is a native of tropical America and probably originated from southern Mexico or central America (Jadhav 2018). It is a highly delicious fruit having mellow and sweet taste with granular textured pulp and pleasant aroma. It is also known as chiku, sapodilla plum or bully and is commercially grown for the production of chuckle which is a gum like substance obtained from latex mainly used for the preparation of chewing gum (Singh 2016). Sapota fruit is a fleshy berry and is a nutritive fruit with a rich source of vitamin A, proteins, carotenoids, phenols and minerals such as Ca, P, Cu and Fe (Ugalat *et al.* 2012). It is mainly cultivated for its edible fruit which is very sweet and delicious when fully ripen and is used for dessert purposes. A sweet sauce can also made from ripe fruits by pressing the flesh, adding orange juice and covering with whipped cream. However, sapota is generally not cooked or preserved, but is sometimes fried (Peiris 2007). Being a climacteric in nature, sapota fruits ripen within a few days after harvest and become softened due to rapid increase in activity of various oxidative enzymes, release

of ethylene, rapid loss of moisture, microbial spoilage and even fruit sensitivity to cold storage (Siddiqui *et al.* 2014). Hence, the proper post-harvest management is required to sustain the shelf life of sapota fruits. Various chemicals such as calcium chloride, potassium permanganate, salicylic acid and kinetin have been used to delay the ripening, to reduce losses and to maintain the colour and quality by slowing down the metabolic activities of the fruit (Tsomu and Patel 2014). Calcium is one of the important element affecting quality and shelf life of sapota. It significantly increases the firmness by thickening the middle lamella of fruit cells owing to increase the formation and deposition of calcium pectate. Potassium permanganate ($KMnO_4$), an ethylene absorber is used in the form of sachets or impregnated in plastic containers or in chemical filters, which absorb and oxidize ethylene effectively into water, carbon dioxide, manganese dioxide and potassium (Wills and Warton 2004). Salicylic acid (SA) is recognised as a plant growth regulator and is a safe chemical to control post-harvest quality by checking the quantity losses of perishable crops. Kinetin is a type of cytokinin, a class of plant hormone that promotes cell division and also found to be effective in extending the shelf life and retarding the post-harvest losses due to moisture loss and degraded metabolism during ripening were induced, without adversely affecting fruit quality.

MATERIALS AND METHODS

The demonstrated study on post-harvest effect of chemicals on storability of sapota cv. Kalipatti was carried out in the laboratory of Department of Horticulture, Khalsa College, Amritsar during the year 2018–2019. The materials used for the present experiment were freshly harvested mature sapota fruits of cv. Kalipatti. The sapota fruits of uniform size, disease and bruise free were picked randomly from all the four directions of the plants with the help of secateurs at physiological mature stage and collected in plastic crates from the sapota orchard of Haveli Khurd (Patiala) and were immediately transferred to the laboratory of Department of Horticulture, Khalsa College, Amritsar. In the laboratory, the fruits were sorted, graded and washed with water. Thereafter, fruits were divided into requisite lot for further handling. In the present study, four types of chemicals viz. calcium chloride(2, 4 and 6%), salicylic acid (1, 2 and 3 Mm), potassium permanganate (1000, 1500 and 2000 ppm) and kinetin (50, 100 and 150 ppm) were used for the application on sapota fruits. The controlled fruits were dipped in distilled water for same period of time. The treated fruits were air dried and 2 kg of fruits from each replication of each treatment were packed in corrugated fibre board (CFB) boxes and stored under cold storage for 5, 10, 15 and 20 days at 15°C–20°C. Present experiment was laid out in Factorial Randomized Block Design (RBD factorial) with 13 treatments replicated three times. The fruits were analyzed after every 4 days at cold storage conditions up to the last stage of shelf life of fruits for different physical and biochemical constituents. Thereafter, fruits were air dried. Changes in different parameters namely weight loss, total soluble solids, total sugars and ascorbic acid content were investigated.

RESULTS AND DISCUSSIONS

Physiological Loss in Weight (%)

Minimum PLW (2.71%) was recorded in T_3 *i.e.* 6% of $CaCl_2$ while it was maximum (48.03%) recorded in T_{13}(control) under cold storage conditions . A perusal of the data clearly explains the positive effect of $CaCl_2$ coating in reducing the PLW of sapota fruits. It might be due to the fact that $CaCl_2$ is known to maintain the fruit cell wall turgidity and also supposed to decrease the water diffusion over the fruit cuticle to reduce the alterations in osmotic potential and reinforce the epidermal cell wall that might had improved the resistance to cell degradation when in contact with free water flow (Shakes and Yataas 1997). The reduction in weight loss might also be due to the maintenance of firmness of fruits by

calcium as it decreased the enzyme activity responsible for cellular structure, which decreased the gaseous exchange (Tsomu and Patel 2014). The loss in weight also increased significantly with the increasing period of storage. Minimum PLW (3.07%) was recorded after 5 days while maximum PLW (78.79 %) was recorded after 30 days of cold storage respectively. All the periods of storage exhibited significant loss in weight. PLW increased progressively with prolongation of storage period irrespective of the post-harvest treatments which might be due to loss of water from fruits after harvest due to transpiration and respiration triggered by physiological metabolic or enzymatic activities (Tsomu *et al* 2015). Significant interaction between the treatments and storage period was observed during the whole research. Minimum PLW (0.45%) was recorded in $CaCl_2$ 6% treated fruits after 5 days of storage showing the same trend after 30 days of storage. The present findings are in consonance with the results reported by Gautam and Chundawat (1989) in sapota cv. Kalipatti, Attri and Singh (1996) and Damodaran *et al* (2001) in sapota cv. Cricket Ball and Sudha *et al* (2007) in sapota cvs. PKM-1 and CO.

Spoilage (%)

From the data, it has been observed that the maximum spoilage 50.37 per cent had been observed in sapota fruits under treatment $T_{9,}$ while minimum spoilage (11.50%) had been noticed in treatment T_3 (6% $CaCl_2$). It has been observed that calcium treated fruits showed significantly lesser extent of spoilage due to stronger intracellular organization and rigidified cell wall, which might have delayed the disintegration of ripening of fruits. Spoilage might have reduced due to controlled transpiration and respiration rates which delayed the disintegration of ripening of fruits. The minimum spoilage (0.92%) was recorded after 5 days while maximum spoilage (83.64%) was after 30 days of storage respectively. The increase in the spoilage losses with the duration of storage period might be attributed to the fact that ripening, ageing, fungal infection and biochemical changes in post-harvest fruits led to softening, spoilage and deterioration of the fruits. The hydrolysis of metabolites in the stored fruits with the time was also a reason for spoilage. Similar findings were reported by Yadav *et al* (2006) in mandarin, Srinu *et al* (2017) in papaya, Tsomu and Patel (2014) in sapota cv. Kalipatti and Patel *et al* (2011) in custard apple. Significant interaction between the treatments and storage period was observed during the analysis of data. No spoilage (0.00%) was recorded after 0 and 5 days of cold storage under all treatments except. The treatments T_7, T_8 and T_9 which showed maximum spoilage loss (100%) after 20 days of storage.

Fruit Firmness (kg/cm^2)

The perusal of data shows that the fruits treated with 6% $CaCl_2$ had maximum firmness 13.89 kg/cm^2. The minimum firmness (6.85 kg/cm^2) was recorded in T_9 (150 ppm kinetin) treated fruits. The calcium proved to be statistically superior treatments in maintaining fruit firmness during cold storage conditions. Higher fruit firmness observed in calcium treated fruits might be due to the higher mechanical strength offered by the calcium as it was a part of cell wall as calcium pectate and also prevented membrane deterioration by restricting rapid peroxidation and its autocatalytic production (Selvaraj and Pal 1982). These results are correlated with the findings of Srinu *et al.* (2017) in papaya and Sudha *et al.* (2017) in PKM-1 cultivar of papaya. The firmness showed a linear decline with the increase in storage intervals. Maximum firmness (19.50 kg/cm^2) was recorded at the day of harvest or zero day. Minimum firmness (1.07 kg/cm^2) was recorded after 30 days of cold storage. It was observed that with the advancement of storage period the firmness decreased which might be due to the increased rate of senescence stage, which promoted respiration, transpiration and other microbial activities which reduced the firmness of fruits. Among interactions maximum firmness (19.83 kg/cm^2) was recorded in $KMnO_4$ 1500 ppm

treated fruits on day of harvest and minimum firmness (2.53 kg/cm^2) was recorded in kinetin 150 ppm fruits after 15 days of cold storage. The current results are also in support with the findings of Tsomu and Patel (2014) in sapota cv. Kalipatti.

TSS (°Brix)

The fruits subjected to $CaCl_2$ 6% (T_3) recorded significantly higher TSS (18.66° Brix). The minimum TSS (10.18^{0}B) was recorded in untreated fruits (T_{13}). The increase in TSS content during storage might be due to the moisture loss, hydrolysis of polysaccharides and concentration of juice as a result of degradation. The above results might be attributed to the reason that $CaCl_2$ coating retarded the ripening and senescence processes and simultaneously reduced the conversion of starch into sugars. The mean maximum TSS content (20.46%) after 10 days was significantly higher as compared to all other storage intervals. Minimum TSS content (4.16%) after 30 days of storage of fruits respectively. Present investigations are in agreement with those of Sahay *et al.* (2015) in banana (Musa spp) cv. Robusta, Madhvi *et al.* (2005) and Gautam and Chundawat (1990) in sapota fruits. Significant interaction was found between treatments and storage period. Lowest TSS (17.08%) was noticed on the day of harvest in treatment T_9 (Kinetin 150 ppm). The research findings of Kumar *et al.* (2016) in sapota fruits are also in line with the present results.

Titratable Acidity (%)

The minimum titratable acidity (0.16%) was noticed in 4% calcium chloride treated fruits and maximum titratable acidity (0.26%) was noticed in 100 ppm kinetin treated fruits. The given data revealed that $CaCl_2$ maintained titratable acidity as compared to other treatments. Decrease in acidity might be attributed to the conversion of acid into sugars during respiration (Srinu 2017). Similar results are reported by Sudha *et al.* (2017) in sapota.

Total Sugars (%)

The perusal of the data with regard to influence of post-harvest application of various chemicals on total sugars in sapota cv. Kalipatti during various storage intervals indicated that total sugars first increased during storage period under each treatment and after few days it also showed a sudden decline till the end of storage with the maximum total sugars (15.48%) in T_3 *i.e.* $CaCl_2$ 6% coating in cold storage conditions whereas minimum total sugars (8.18%) were found in control under cold storage conditions. This might be due to the rapid conversion of polysaccharides into sugars at the earlier stage and later to an increased concentration of organic solutes as a consequence. These results are in close conformity with those obtained by Singh and Mandal (2000) in litchi, Singh *et al.* (2007) in passion fruit.

Ascorbic Acid (mg/100g pulp)

The data with regard to influence of post-harvest chemical treatments on ascorbic acid in sapota cv. Kalipatti during various storage intervals revealed that after 30 days of storage, maximum ascorbic acid (12.95 mg/100 g) was found in T_3 *i.e.* 6 per cent calcium chloride coating in cold storage conditions whereas minimum ascorbic acid (7.08 mg/100 g) was found in T_{13} (untreated fruits) under cold storage conditions. The increase in total sugars with the storage interval upto 15 days might be due to the hydrolysis of starch, yielding mono and disaccharides. Thereafter, decline (12.95 mg/100 g) was found in T_3 *i.e.* 6% calcium chloride coating whereas minimum ascorbic acid (7.08 mg/100 g) was found in T_{13} (untreated fruits) under cold storage conditions. The higher ascorbic acid content observed in calcium chloride treated fruits might be due to the breakdown of physiological process (Srinu *et al.* 2017). The findings are in confirmity with Yuvraj *et al.* (1999)

in mango, Patel *et al.* (2011) in custard apple, Tomu *et al.* (2015) in sapota cv. Kalipatti, Ruoyi *et al.* (2005) in peach, Akhtar *et al.* (2010) and Gohlani and Bisen (2012) in custard apple.

Table 1: Influence of Post-Harvest Application of Chemicals ($CaCl_2$, SA, Kinetin and $KMnO_4$) on PLW (%) in sapota cv. Kalipatti during Cold Storage

Treatments	Day 0	Day 5	Day 10	Day15	Day 20	Day 25	Day 30	Mean
T_1 (2% $CaCl_2$)	0.00	0.00	1.00	13.42	24.81	28.79	31.74	14.25
T_2 (4% $CaCl_2$)	0.00	0.00	0.61	12.96	22.74	26.93	29.48	13.24
T_3 (6% $CaCl_2$)	0.00	0.00	0.56	12.01	19.15	22.63	26.19	11.50
T_4 (1Mm SA)	0.00	0.00	2.43	15.52	32.19	100	100	35.73
T_5 (2Mm SA)	0.00	0.00	2.90	16.13	31.75	100	100	35.82
T_6 (3Mm SA)	0.00	0.00	3.75	15.93	29.46	66.70	100	30.83
T_7 (50 ppm Kinetin)	0.00	2.31	15.75	28.16	100	100	100	49.46
T_8 (100 ppm Kinetin)	0.00	2.95	16.12	30.15	100	100	100	49.88
T_9 (150 ppm Kinetin)	0.00	2.01	18.84	31.79	100	100	100	50.37
T_{10}(1000ppm $KMnO_4$)	0.00	0.00	3.95	16.15	20.63	35.29	100	25.14
T_{11}(1500ppm $KMnO_4$)	0.00	0.00	3.80	15.83	24.92	32.47	100	25.28
T_{12}(2000ppm $KMnO_4$)	0.00	0.00	0.82	14.35	21.64	30.37	100	23.88
T_{13} control	0.00	4.81	22.63	45.97	100	100	100	53.34
Mean	0.00	0.92	7.16	20.64	48.25	64.86	83.64	

C D at Significance Level of 5%
Treatments 3.72
Days 2.73
Interaction 9.8

Table 2: Influence of Post-Harvest Application of Chemicals ($CaCl_2$, SA, Kinetin and $KMnO_4$) on Spoilage (%) in Sapota cv. Kalipatti during Cold Storage.

Treatments	Day 0	Day 5	Day 10	Day 15	Day 20	Day 25	Day 30	Mean
T_1 (2% $CaCl_2$)	0.00	0.63	1.02	2.73	4.53	6.09	8.44	3.34
T_2 (4% $CaCl_2$)	0.00	0.55	0.97	1.88	3.74	5.45	8.02	2.94
T_3 (6% $CaCl_2$)	0.00	0.45	0.88	1.75	3.35	4.66	7.92	2.71
T_4 (1Mm SA)	0.00	2.90	4.28	5.74	13.73	100	100	32.37
T_5 (2Mm SA)	0.00	3.23	5.62	8.26	14.01	100	100	33.01
T_6 (3Mm SA)	0.00	3.43	5.72	8.45	14.95	100	100	33.22
T_7 (50 ppm Kinetin)	0.00	4.73	8.29	15.67	100	100	100	46.95
T_8 (100 ppm Kinetin)	0.00	4.95	8.66	19.93	100	100	100	47.64
T_9 (150 ppm Kinetin)	0.00	5.39	8.04	21.81	100	100	100	47.89
T_{10}(1000ppm $KMnO_4$)	0.00	2.44	4.62	5.98	6.49	9.28	100	18.40
T_{11}(1500ppm $KMnO_4$)	0.00	2.19	3.25	4.85	7.98	9.01	100	18.18
T_{12}(2000ppm $KMnO_4$)	0.00	2.02	3.09	4.75	6.65	8.92	100	17.91
T_{13} control	0.00	7.00	10.31	18.90	100	100	100	48.03
Mean	0.00	3.07	4.98	9.28	36.57	57.18	78.79	

C D at Significance Level of 5%
Treatments 0.47
Days 0.34
Interaction 1.24

Table 3: Influence of Post-Harvest Application of chemicals ($CaCl_2$, SA, Kinetin and $KmnO_4$) on Firmness (kg/cm^2) in Sapota cv. Kalipatti during Cold Storage

Treatments	Day 0	Day 5	Day 10	Day 15	Day 20	Day 25	Days 30	Mean
T_1 (2% $CaCl_2$)	19.32	18.64	17.12	14.82	12.12	7.93	4.20	13.45
T_2 (4% $CaCl_2$)	19.26	18.89	17.29	15.01	12.24	6.73	4.40	13.40
T_3 (6% $CaCl_2$)	19.40	18.96	17.38	15.29	12.29	8.50	5.43	13.89
T_4 (1Mm SA)	19.60	18.52	13.33	9.93	4.40	0.00	0.00	9.39

T_5 (2Mm SA)	19.40	18.60	13.15	9.61	4.07	0.00	0.00	9.26
T_6 (3Mm SA)	19.22	17.98	13.04	9.01	3.70	0.00	0.00	8.99
T_7 (50 ppm Kinetin)	19.31	16.22	11.93	4.13	0.00	0.00	0.00	7.37
T_8 (100 ppm Kinetin)	19.39	16.05	9.12	3.20	0.00	0.00	0.00	6.82
T_9 (150 ppm Kinetin)	19.74	16.16	9.54	2.53	0.00	0.00	0.00	6.85
T_{10}(1000ppm $KMnO_4$)	19.72	18.23	15.09	14.38	11.32	4.37	0.00	11.87
T_{11}(1500ppm $KMnO_4$)	19.83	18.58	15.14	14.29	12.17	4.20	0.00	12.03
T_{12}(2000ppm $KMnO_4$)	19.60	18.54	15.29	14.32	12.31	4.07	0.00	12.01
T_{13} control	19.72	14.02	9.91	3.21	0.00	0.00	0.00	6.69
Mean	19.50	17.64	13.64	9.97	6.50	2.75	1.07	

C D at Significance Level of 5%

Treatments 0.43

Days 0.32

Interaction 1.16

Table 4: Influence of Post-Harvest Application of Chemicals ($CaCl_2$, SA, Kinetin and $KmnO_4$) on TSS(^{0}Brix) of Sapota Kalipatti during Cold Storage

Treatments	Day 0	Day 5	Day 10	Day 20	Day 20	Day 25	Day 30	Mean
T_1 (2% $CaCl_2$)	17.29	17.64	19.3	20.6	18.49	18.15	17.98	18.49
T_2 (4% $CaCl_2$)	17.42	17.86	18.46	21.17	18.63	18.37	18.01	18.56
T_3 (6% $CaCl_2$)	17.41	17.43	18.88	21.44	18.71	18.66	18.12	18.66
T_4 (1Mm SA)	17.37	18.60	19.02	20.68	16.64	0.00	0.00	13.18
T_5 (2Mm SA)	17.48	18.48	20.47	20.84	16.16	0.00	0.00	13.34
T_6 (3Mm SA)	17.07	18.73	21.44	21.03	16.36	0.00	0.00	13.51
T_7 (50 ppm Kinetin)	18.02	18.71	21.91	17.49	0.00	0.00	0.00	10.87
T_8 (100 ppm Kinetin)	17.26	19.04	23.08	17.67	0.00	0.00	0.00	11.00
T_9 (150 ppm Kinetin)	17.08	18.99	23.26	17.98	0.00	0.00	0.00	11.04
T_{10}(1000ppm $KMnO_4$)	17.49	18.62	20.42	22.97	19.17	16.14	0.00	16.40
T_{11}(1500ppm $KMnO_4$)	17.13	17.33	18.95	21.44	19.38	17.08	0.00	15.90
T_{12}(2000ppm $KMnO_4$)	17.46	17.21	19.80	21.62	19.94	18.33	0.00	16.33
T_{13} control	17.38	18.01	21.08	14.84	0.00	0.00	0.00	10.18
Mean	17.37	18.20	20.46	19.98	12.57	8.21	4.162	

C D at Significance Level of 5%

Treatments 0.53

Days 0.39

Interaction 1.40

Table 5: Influence of Post-Harvest Application of Chemicals ($CaCl_2$, SA, Kinetin and $KmnO_4$) on Titratable Acidity (%) in Sapota cv. Kalipatti during Cold Storage

Treatments	Day 0	Day 5	Day 10	Day 15	Day 20	Day 25	Day 30	Mean
T_1 (2% $CaCl_2$)	0.25	0.22	0.19	0.17	0.16	0.14	0.13	0.18
T_2 (4% $CaCl_2$)	0.24	0.21	0.18	0.16	0.15	0.12	0.12	0.16
T_3 (6% $CaCl_2$)	0.23	0.20	0.19	0.17	0.16	0.14	0.11	0.17
T_4 (1Mm SA)	0.25	0.26	0.27	0.24	0.23	0.00	0.00	0.25
T_5 (2Mm SA)	0.26	0.26	0.25	0.23	0.22	0.00	0.00	0.24
T_6 (3Mm SA)	0.27	0.25	0.24	0.22	0.20	0.00	0.00	0.23
T_7 (50 ppm Kinetin)	0.28	0.27	0.26	0.23	0.00	0.00	0.00	0.26
T_8 (100 ppm Kinetin)	0.27	0.26	0.25	0.22	0.00	0.00	0.00	0.25
T_9 (150 ppm Kinetin)	0.28	0.25	0.24	0.21	0.00	0.00	0.00	0.24
T_{10}(1000ppm $KMnO_4$)	0.26	0.25	0.22	0.20	0.19	0.17	0.00	0.21
T_{11}(1500ppm $KMnO_4$)	0.25	0.24	0.21	0.19	0.18	0.16	0.00	0.20
T_{12}(2000ppm $KMnO_4$)	0.24	0.23	0.2	0.18	0.17	0.15	0.00	0.19
T_{13} control	0.28	0.26	0.23	0.21	0.00	0.00	0.00	0.24
Mean	0.25	0.24	0.22	0.20	0.18	0.14	0.12	

C D at Significance Level of 5%
Treatments N/S
Days N/S
Interaction N/S

Table 6: Influence of Post-Harvest application of Chemicals ($CaCl_2$, SA, Kinetin and $KMnO_4$) on Total Sugars (%) in Sapota cv. Kalipatti during Cold Storage

Treatments	Day 0	Day 5	Day 10	Day 15	Day 20	Day 25	Day 30	Mean
T_1 (2% $CaCl_2$)	13.40	13.98	14.82	15.02	15.28	17.13	15.24	14.98
T_2 (4% $CaCl_2$)	13.49	14.59	15.17	14.46	16.39	17.25	14.46	15.11
T_3 (6% $CaCl_2$)	13.43	15.04	15.22	15.93	16.42	17.62	14.72	15.48
T_4 (1Mm SA)	13.52	14.55	15.09	15.51	14.82	0.00	0.00	10.50
T_5 (2Mm SA)	13.61	14.60	15.24	15.83	14.91	0.00	0.00	10.59
T_6 (3Mm SA)	13.62	14.89	15.31	15.84	15.13	0.00	0.00	10.68
T_7 (50 ppm Kinetin)	13.81	14.54	15.37	15.89	13.02	0.00	0.00	10.37
T_8 (100 ppm Kinetin)	13.63	14.98	15.83	16.13	13.89	0.00	0.00	10.63
T_9 (150 ppm Kinetin)	13.69	14.00	16.07	16.24	13.73	0.00	0.00	10.53
T_{10}(1000ppm $KMnO_4$)	13.73	14.94	15.26	15.92	16.80	13.90	0.00	12.93
T_{11}(1500ppm $KMnO_4$)	13.89	14.62	15.10	15.53	16.38	13.60	0.00	12.73
T_{12}(2000ppm $KMnO_4$)	13.44	14.23	14.99	15.49	16.12	13.25	0.00	12.50
T_{13} control	13.99	14.84	15.69	12.79	0.00	0.00	0.00	8.18
Mean	13.63	14.60	15.32	15.42	14.06	7.13	3.41	

C D at Significance Level of 5%
Treatments 0.54
Days 0.40
Interaction 1.45

Table 7: Influence of Post-Harvest application of Chemicals ($CaCl_2$, SA, Kinetin and $KmnO_4$) on Ascorbic Acid (mg/100g) in Sapota cv. Kalipatti during Cold Storage

Treatments	Day 0	Day 5	Day 10	Day 20	Day 20	Day 25	Day 30	Mean
T_1 (2% $CaCl_2$)	13.36	13.3	12.76	12.4	12.31	12.09	11.40	12.51
T_2 (4% $CaCl_2$)	13.43	13.21	13.12	12.94	12.82	12.61	12.23	12.90
T_3 (6% $CaCl_2$)	13.16	13.10	13.15	13.00	12.96	12.83	12.49	12.95
T_4 (1Mm SA)	13.75	12.96	13.10	12.69	12.52	0.00	0.00	9.28
T_5 (2Mm SA)	13.33	13.18	13.00	12.62	12.42	0.00	0.00	9.22
T_6 (3Mm SA)	13.62	13.09	12.94	12.62	11.54	0.00	0.00	9.11
T_7 (50 ppm Kinetin)	13.48	13.66	12.98	11.93	0.00	0.00	0.00	7.43
T_8 (100 ppm Kinetin)	13.23	11.98	12.82	11.63	0.00	0.00	0.00	7.09
T_9 (150 ppm Kinetin)	14.01	13.43	12.70	11.52	0.00	0.00	0.00	7.38
T_{10}(1000ppm $KMnO_4$)	13.19	13.14	12.11	13.02	12.95	12.70	0.00	11.01
T_{11}(1500ppm $KMnO_4$)	13.42	13.39	13.32	13.07	12.49	12.04	0.00	11.10
T_{12}(2000ppm $KMnO_4$)	13.39	13.30	13.18	12.70	12.96	12.43	0.00	11.13
T_{13} control	13.07	12.81	12.46	11.27	0.00	0.00	0.00	7.08
Mean	13.42	13.11	12.89	12.41	8.69	5.74	2.77	

C D at Significance Level of 5%
Treatments 0.53
Days 0.39
Interaction 1

CONCLUSIONS

It is concluded from the present study that the application of 4 and 6% $CaCl_2$ as post-harvest application under cold storage conditions improved the quality and post-harvest life of sapota fruits. The present study suggests that among the different treatments under study the treatment of 2, 4 and 6 per cent $CaCl_2$ in cold storage conditions had minimum physiological

loss in weight as compared to control and other treatments. The application of 6 per cent $CaCl_2$ in cold storage conditions seems to hold promise and considered the most benefit tested one in extending the shelf life and quality of sapota.

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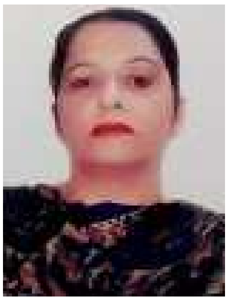

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